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A Propulsive Efficiency Model for Pulsed-Jet Propulsion[1] PAUL S. KRUEGER, SMU — Mechanical pulsed jets functionally similar to those utilized by biological jetters such as squid are known to yield elevated thrust in comparison to equivalent steady jets due to the formation of vortex rings with each jet pulse and the concomitant over-pressure at the nozzle exit plane. Although speculated to have advantages for propulsive efficiency as well, the influence of vortex ring formation and over-pressure on propulsive efficiency has not been quantified. The present work proposes a simple model of pulsed jet propulsion where the effect of vortex ring formation on thrust and kinetic energy are accounted for through lumped over-pressure terms in the momentum and energy equations. Time-averaged propulsive efficiency is then formulated from the resulting expressions for thrust and excess kinetic energy. For comparison with steady jet propulsion, it assumed that the vehicle drag is the same for pulsed and steady propulsion at the same vehicle speed. Using measurements of the over-pressure terms from static pulsed jets, the results suggest that the propulsive efficiency of pulsed jets can exceed that for steady jets for short pulses and low vehicle Reynolds number.

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